

# Rational utilization of plantation grown *Acacia mangium* willd

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**Abstract** *Acacia mangium* Willd., a leguminous tree species of the sub-family mimosoideae and native of North Queens land, Australia, along with *Acacia auriculaeformis* is finding wide acceptance for afforestation and adaptable to widely differing soils on degraded land and on hill slopes overgrown with weeds. Because of fast growth and straight bole it has achieved wide popularity and many planters, progressive farmers and forest departments have raised the plantation in Gujarat, Orissa, Karnataka, Kerala and in many parts of the country. As this species is raised for pulp and paper, several enquiries are received from the above said planters and forest departments about its properties and engineering utility and suitability of this species for its commercial uses. Therefore, various anatomical, physical and mechanical properties of 18-year-old plantation grown *A. mangium* Willd. from Orissa have been studied to evaluate the wood quality parameters for recommending the timber for various end use applications. The timber exhibits distinct sapwood and heartwood. The heartwood is brownish yellow in colour, medium textured and lustrous. Based on testing results on physical and mechanical properties, suitability indices were computed and timber is classified as extremely heavy, hard, very strong, tough, and liable to warp and crack badly. The wood is found suitable for furniture, door and window frames and shutters and utility items for household goods like tables, teapots etc. The experience of artisans working in the handicraft design and development centers has indicated the potential of the timber for making export

orientated artifacts because of the glossy and smooth surface finish after polishing.

**Keywords** *Acacia mangium* · Plantations · Wood properties · Timber uses

## Introduction

*Acacia mangium*, Willd., is a leguminous tree species of the sub-family mimosoideae. It is native of North Queensland, Australia and also found in Papua New Guinea and the Molaccas (Indonesia). *A. mangium* along with *Acacia auriculaeformis* is finding wide acceptance for afforestation and plantations are raised for pulp in peninsular India. The growth is comparable to that of recognized plantation species such as *Gmelina arborea*, *Paraserianthes falcataria* and *Anthocephalus chinensis*. The species is adaptable to widely differing soils on degraded land and on hill slopes overgrown with weeds. *A. mangium* is a large fast growing tree up to 30 m tall with straight bole. As this species is raised for pulp and paper, several enquiries are received from the planters and departments about its properties and engineering utility and suitability of this species for its commercial uses. Some of the anatomical and mechanical properties of this species have been studied by Vijendra Rao and Sujatha (2004) and Damodaran and Chacko (1996). Kumar et al. (2004, 2006) studied *A. mangium* of 6 year old grown at Wada, Pune of Maharashtra under irrigated conditions and 9 year old trees from Karnataka indicated that there is scope for this timber to use for value added product like furniture etc., In order to meet wise investment, a thorough study on this species of higher age groups of 18 years age (having girth of 70–95 cm) was conducted. After study and analyzing the

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data many value added products were made like chairs, tables, artifacts etc.

## Materials and methods

*A. mangium* trees of 18 years were selected statistically as per the procedure given in BIS: 2455 (Anon. 1990). The trees will be divided into boles depending upon the length, after debarking prophylactic treatment was given to protect it from fungal infection. The logs were converted into scantlings of  $6.25 \times 6.25$  cms in a saw mill. Samples were prepared from these scantlings and tested in both green and air-dry condition for their physical and mechanical properties as per the procedure given in BIS: 1708 (Anon. 1986). Their suitability indices for various industrial and engineering uses were determined as per the procedure given by Shekar and Gulati (1972). Many prototype articles were made by artisans of office of development commissioner, Regional design and Technical wing, Bangalore.

## Results and discussion

The data generated on anatomical, physical and mechanical properties were evaluated to find the wood quality. Based on the strength data the timber obtained from *A. mangium* trees was classified and recommended for various end uses.

### Anatomical properties

The sapwood and heartwood are distinct. The heartwood is brownish yellow in colour. The wood is medium textured and lustrous. The wood is diffuse porous and growth rings are indistinct to distinct.

### Physical properties

The average values of specific gravity at 12 % moisture content and shrinkage (radial, tangential and volumetric) along with comparison with the teak values are shown in Table 1. Based on shrinkage, the timber is classified as

**Table 1** Average shrinkage values of *A. mangium* and its comparison with *Tectona grandis*

Properties	<i>Acacia mangium</i>	<i>Tectona grandis</i>
Specific gravity at 12 % M.C.	0.643	0.604
Shrinkage (%)		
Radial	2.5	2.2
Tangential	5.8	4.1
Volumetric	9.1	6.5

steady timber and grouped along with *Dalbergia Sissoo* and *Adina cordifolia*. The values of all the shrinkages (radial, tangential and volumetric) were found slightly higher than teak.

### Mechanical properties

The mechanical properties in green and air dry condition were determined. Based on these properties, the comparative suitability indices were evaluated and shown in Table 2. Based on suitability indices, the timber is classified as extremely heavy, hard, very strong, tough and liable to warp and crack badly. The wood is found suitable for furniture, door, and window frames and shutters and utility items for household goods like tables, teapots etc.

### Wood working qualities

The wood working qualities of the timber were also evaluated. The timber planes well giving a smooth and lustrous planed surface. Sanding is easy with no torn fibres on the finished face. Drilling is easy. Turning is also easy. Few prototype products made of *A. mangium* wood is shown in Fig. 1.

## Conclusion

The heartwood is brownish yellow in colour, medium textured and lustrous. Based on testing results suitability indices were computed and timber is classified as extremely heavy, hard, very strong, tough and liable to warp and crack badly. The wood is found suitable for furniture, door, and window frames and shutters and utility items for

**Table 2** Comparative suitability index of *A. mangium* (taken teak as 100)

S. No.	Properties	Comparative suitability index
1	Strength as a beam	96
2	Stiffness as a beam	84
3	Suitability as a post	83
4	Shock resisting ability	209
5	Retention of shape	85
6	Shear	83
7	Refractoriness	79
8	Hardness	100
9	Nail holding power	75
10	Screw holding power	70
11	Heaviness	106



**Fig. 1** Products made out of *A. mangium*

household goods like tables, teapots etc. The experience of artisans working in handicraft design and development centers has indicated the potential of the timber for making export oriented artifacts because of the glossy and smooth surface finish after polishing.

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